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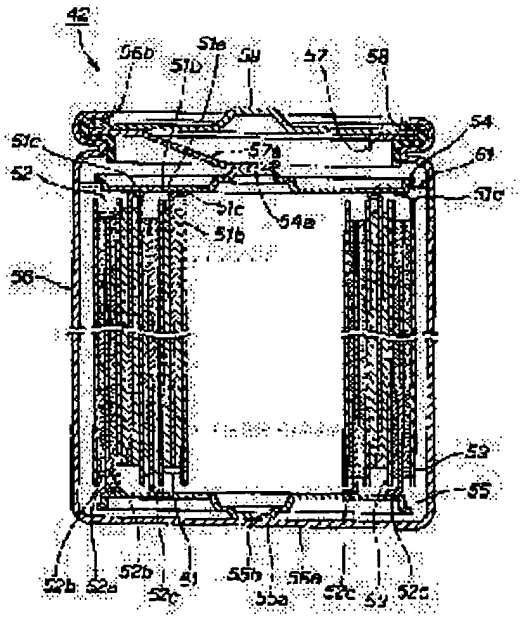
(54) ACCUMULATING ELEMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To improve reliability, while lowering the internal resistance by laser- welding a part of one edge of a positive and a negative electrodes housed in a case with the electrolyte in a condition in which it is not coated with an active material to a positive and a negative electrode terminals.

SOLUTION: A positive and a negative electrodes 51, 52 laminated through a separator 53 and housed in a conductive case 56 of a battery cell 42 have a positive and a negative electrode foils 51a, 52a, the active material 51b, 51b coated on both surfaces thereof, and an upper welding part 51c of the positive electrode 51 and a lower welding part 52c of the negative electrode 52. The welding parts 51c, 52, which are not coated with the active material 51b, 52b, are laser-welded to collector plates 54, 55 as positive and



negative electrode terminals for securing connection, and have conductivities higher than that of the parts coated with the active material 51b, 52b. The collector plates 54, 55 are preferably formed with a spiral groove or the like for insertion of the ends of the positive and the negative electrodes 51, 52, and an area of the bonding surface is increased, while the electrical resistance is lowered. The kinds of parts can be reduced by using each common collector plate 54, 55 in the positive electrode side and the negative electrode side.

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* NOTICES *

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CLAIMS

[Claim]
[Claim 1] The accumulation-of-electricity element characterized by having prepared the non-painted fraction which does not apply an active material at one side of aforementioned positive and negative-electrode plate in positive and the negative-electrode plate contained with the electrolytic solution in the case, and carrying out laser welding of this non-painted fraction to it at positive and a negative-electrode terminal in the accumulation-of-electricity element of the format which combines positive and a negative-electrode terminal.
[Claim 2] The accumulation-of-electricity element of the claim 1 publication characterized by forming the slot which inserts the edge of aforementioned positive and negative-electrode plate in aforementioned positive and negative-electrode terminal.
[Claim 3] The accumulation-of-electricity element of claim [which is characterized by having made aforementioned positive and negative-electrode plate into the shape of a roll in piles, and carrying out laser welding of aforementioned positive and negative-electrode terminal to the edge of this roll-like electrode plate] 1, or claim 2 publication.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed description]
[0001]
[The technical field to which invention belongs] this invention relates to enhancement of an accumulation-of-electricity element.
[0002]
[Prior art] This invention persons proposed the technique which makes contact resistance small by preparing previously the non-painted fraction which does not paint an active material in one side of positive and the negative-electrode plate of an accumulation-of-electricity element by Japanese Patent Application No. 103050 [nine to] "an accumulation-of-electricity element", assembling by applying positive and a negative-electrode terminal to this non-painted fraction, and raising a productivity, and increasing the touch area of positive and a negative-electrode plate, and positive and a negative-electrode terminal. The following drawing explains this technique.
[0003] Drawing 12 is the cross section of the conventional accumulation-of-electricity element which applied positive and the negative-electrode terminal to the non-painted fraction of positive and a negative-electrode plate. the accumulation-of-electricity element 100 The positive-electrode plate 101 and the negative-electrode plate 102 which applied the active material to both sides, respectively, The separator 103,103 formed between positive [these] and the negative-electrode plate 101,102, The collecting electrode plate 104 which is the positive-electrode terminal which hit against the upper part of the positive-electrode plate 101, and the collecting electrode plate 105 which is the negative-electrode terminal which hit against the lower part of the negative-electrode plate 102, The case 106 with the conductivity which contains positive [these] and the negative-electrode plate 101,102, the separator 103,103, and the collecting electrode plate 104,105, The electric conduction plate 107 which pushes positive [these] and the negative-electrode plate 101,102, the separator 103,103, and the collecting electrode plate 104,105 against the pars basilaris ossis occipitalis of this case 106, opening of a case 106 -- the electric conduction plate 107 -- a gasket 108 -- minding -- it consists of a closed lid 109 and the electrolytic solution 111 poured in into the case 106
[0004]
[Object of the Invention] the above-mentioned technique -- a collecting electrode plate 105 -- the negative-electrode plate 102 -- ****** and the positive-electrode plate 101 -- a collecting electrode plate 104 -- pressing **** -- power is taken out to the exterior by things In order to be asked for the further miniaturization to an accumulation-of-electricity element, lightweight-izing, and large capacity-ization and to take out power more efficiently according to the need of a hybrid vehicle, an electric vehicle, an electric bicycle, etc. in recent years, a reduction of the internal resistance of an accumulation-of-electricity element is desired. Moreover, by the above-mentioned vehicle, in order to use two or more accumulation-of-electricity elements, the quality by which each accumulation-of-electricity element was stabilized is also demanded. Then, the purpose of this invention reduces internal resistance more, and is to offer the accumulation-of-electricity element which raised the reliability.
[0005]

[The means for solving a technical problem] In order to attain the above-mentioned purpose, in the accumulation-of-electricity element of the format which combines positive and a negative-electrode terminal with positive and the negative-electrode plate contained with the electrolytic solution in the case, the claim 1 of this invention prepared the non-painted fraction which does not apply an active material at one side of positive and a negative-electrode plate, and carried out laser welding of this non-painted fraction to positive and the negative-electrode terminal. By laser welding, positive and a negative-electrode terminal are certainly combined with positive and a negative-electrode plate, respectively. Moreover, the electric resistance of the bond part of positive and a negative-electrode plate, and positive and a negative-electrode terminal becomes smaller.
[0006] The claim 2 formed the slot which inserts the edge of positive and a negative-electrode plate in positive and a negative-electrode terminal. The area of the bond part of positive and a negative-electrode plate, and positive and a negative-electrode terminal becomes large, and the electric resistance of a bond part becomes smaller.
[0007] The claim 3 made positive and the negative-electrode plate the shape of a roll in piles, and carried out laser welding of positive and the negative-electrode terminal to the edge of this roll-like electrode plate. In order that positive and a negative-electrode terminal may contact equally the non-painted fraction of positive and a negative-electrode plate, combination by laser welding becomes an authenticity more, and the electric resistance of the bond part of positive and a negative-electrode plate, and positive and a negative-electrode terminal becomes smaller.
[0008]
[Gestalt of implementation of invention] The gestalt of enforcement of this invention is explained below based on an attached drawing. In addition, a drawing shall be seen to the sense of a sign. Drawing 1 is the side elevation of the electric-with pedal bicycle concerning this invention. the electric-with pedal bicycle 1 A frame 2 and the head tube 4 attached in the pars anterior of this frame 2, The handle stem 5 of the upper part attached in this head tube 4 possible [rotation], and the lower front fork 6, It consists of the handle bar 8 attached in the handle stem 5 by the handle lug 7, a front wheel 11 attached in the soffit of the front fork 6 possible [rotation], and a rear wheel 12 attached in the posterior extremity of a frame 2.
[0009] A frame 2 consists of rear fork 15 delayed to back from the down frame 14 prolonged in the back lower part of a head tube 4, the seat pillar which was started from the posterior extremity of this down frame 14, and not to illustrate, and the posterior extremity of the above-mentioned down frame 14, and rear sub fork 16 with which these seat pillars and rear fork 15 posterior extremity were spanned.
[0010] The down frame 14 attaches a battery 17 removable, and forms a mechanical component 18 in the posterior-extremity section. The rear fork 15 is attached in a posterior extremity possible [rotation of the rear wheel 12 and the chain sprocket 21].
[0011] A mechanical component 18 consists of an electrical motor 22, a drive gear 23 driven by this electrical motor 22, and the pedals 24 and 24 (the back is omitted) attached in this drive gear 23. If it connects with a battery 17, and the rotation and the torque control unit not to illustrate and a man steps on pedals 24 and 24, in response to this, an electrical motor 22 will rotate, will generate torque, and will assist treading strength.
[0012] The drive gear 23 tells driving force to the chain sprocket 21 through a chain 25, and a rear wheel 12 is rotated. Here, for a sheet and 33, as for a rear brake and 35, chain covering and 34 are [the pipe with which attached a basket and 28 in the fender of a front wheel 11, and 26 attached 31 in the seat pillar for a front brake and 27, and 32 / the fender of a rear wheel 12 and 36] stands.
[0013] It is the battery cell 42 as an accumulation-of-electricity element to which drawing 2 is the perspective diagram of the battery concerning this invention, and the battery 17 carried out the series connection of the plurality into the receipt case 41 and this receipt case 41. -- (-- shows plurality.) the following -- the same . It consists of the connector 43 for connecting these batteries cell 42 -- to an electrical motor 22 (referring to drawing 1), a fuse 44 for preventing the overcurrent between these batteries cell 42 -- and the electrical motor 22, and a charge plug socket 45 for charging battery cell 42 -- with home power. In addition, 46 is a handle.

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[0014] Drawing 3 is the cross section (gestalt of the 1st enforcement) showing the battery cell concerning this invention. the battery cell 42 The separators 53 and 53 formed between the positive-electrode plate 51, the negative-electrode plate 52, and positive [these] and negative-electrode plates 51 and 52, The collecting electrode plate 54 as a positive-electrode terminal which carried out laser welding to the upper part of the positive-electrode plate 51, The collecting electrode plate 55 as a negative-electrode terminal which carried out laser welding to the lower part of the negative-electrode plate 52, The case 56 with the conductivity which contains positive [these] and the negative-electrode plates 51 and 52, the separators 53 and 53, and the collecting electrode plates 54 and 55, The electric conduction plate 57 which is an elastic component for pushing positive [these] and the negative-electrode plates 51 and 52, the separators 53 and 53, and the collecting electrode plates 54 and 55 against the pars-basilaris-ossis-occipitalis 56a side of this case 56, opening 56b of the upper part of a case 56 -- the electric conduction plate 57 -- a gasket 58 -- minding -- it consists of a closed lid 59 and the electrolytic solution 61 poured in into the case 56

[0015] The positive-electrode plate 51 consists of positive-electrode foil 51a and the active materials 51b and 51b applied to both sides of this positive-electrode foil 51a. In addition, 51c-- is the weld zone of positive-electrode foil 51a and the collecting electrode plate 54. The negative-electrode plate 52 consists of negative-electrode foil 52a and the active materials 52b and 52b applied to both sides of this negative-electrode foil 52a. In addition, 52c-- is the weld zone of negative-electrode foil 52a and the collecting electrode plate 55.

[0016] A separator 53 insulates the positive-electrode plate 51 and the negative-electrode plate 52. Although collecting electrode plates 54 and 55 were the same and were built into vertical reverse, respectively, they changed the convenience top sign of an explanation.

[0017] Thus, by using the common collecting electrode plates 54 and 55 by the positive-electrode and negative-electrode side, the modality of parts can be reduced and a manufacturing cost can be held down. The electric conduction plate 57 has ****** 57a which generates ****** by making it bend at the time of with [a group]. Here, you may carry out laser welding of the negative-electrode plate 52 to a case 56, without using the collecting electrode plate 55 by the side of a negative electrode.

[0018] Drawing 4 is the decomposition perspective diagram (gestalt of the 1st enforcement) showing the battery cell concerning this invention. in a case 56 The disc-like collecting electrode plate 55, The electrode assembly 62 as a roll-like electrode plate which wound the separator 53 around the outside of the positive-electrode plate 51 in piles on the outside of a separator 53 and the separator 53 at the outside of the negative-electrode plate 52 and the negative-electrode plate 52, Inserting the disc-like collecting electrode plate 54 in this order, inserting minor-diameter section 58a prepared in opening 56b of the upper limit of a case 56 at the gasket 58, and inserting the electric conduction plate 57 and the lid 59 in the internal surface of parietal bone of major-diameter section 58b prepared in the gasket 58 is shown.

[0019] After the battery cell 42 inserts the electric conduction plate 57 and the lid 59 in opening 56b of a case 56, as shown in drawing 3 , it extracts a case 56 to the method of the inside of a path, and seals the upper part of a case 56. Collecting electrode plates 54 and 55 form heightss 54a and 55a in the center.

[0020] Heights 54a is a fraction in contact with ****** 57a of the electric conduction plate 57. Heights 55a is a fraction which carries out laser welding to pars-basilaris-ossis-occipitalis 56a (refer to drawing 3) of a case 56. (55b shown in drawing 3 is a weld zone.) In addition, you may perform combination with heights 55a and pars-basilaris-ossis-occipitalis 56a with other welding processes. A case 56 carries out insulating processing of the superficies electrically except for pars-basilaris-ossis-occipitalis 56a (refer to drawing 3).

[0021] Drawing 5 is drawing explaining the electrode plate concerning this invention, and except for one side of positive-electrode foil 51a, the positive-electrode plate 51 applies active material 51b, and secures the non-painted fractions 51d and 51d (51d of a background is un-illustrating) to width of face fixed [one side of the upper parts of the positive-electrode plate 51].

[0022] Except for one side of negative-electrode foil 52a, the negative-electrode plate 52 applies active material 52b, and secures the non-painted fractions 52d and 52d (52d of a background is un-illustrating) to width of face fixed [one side of the lower parts of the negative-electrode plate 52]. These non-

painted fractions 51d, 51d, 52d, and 52d have good conductivity compared with the fraction which applied active materials 51b and 52b.
[0023] Roll these positive-electrode plates 51 and the negative-electrode plate 52 so that active material 51b and 52b fraction may lap through a separator 53, and the non-painted fractions 51d and 52d are made to project from the edge of the roll-like electrode assembly 62, and it contains in a case 56 (refer to drawing 4).
[0024] By having made positive and the negative-electrode plates 51 and 52 into the roll-like electrode assembly 62 in piles, as described above, since collecting electrode plates 54 and 55 (refer to drawing 3) are equally contacted at the edge of the electrode assembly 62 and laser welding is made, combination by laser welding can be more made into an authenticity, and the electric resistance of the bond part of positive and the negative-electrode plates 51 and 52, and the collecting electrode plates 54 and 55 can be made smaller. Therefore, internal resistance of the battery cell 42 (refer to drawing 3) can be made smaller.
[0025] Drawing 6 (a) - (d) is the plan of the collecting electrode plate concerning this invention, and shows the gestalt of laser welding of a collecting electrode plate, and positive and a negative-electrode plate in two or more examples. Except for heights 54a (or heights 55a of a collecting electrode plate 55) of a collecting electrode plate 54, laser welding of the (a) is carried out to the shape of a straight line. Except for heights 54a (or heights 55a), laser welding of the (b) is carried out to the shape of a cross joint.
[0026] Except for heights 54a (or heights 55a), laser welding of the (c) is carried out to 60 degree regular intervals. Except for heights 54a (or heights 55a), laser welding of the (d) is carried out to 45 degree regular intervals.
[0027] Drawing 7 is a cross section explaining the technique of laser welding of positive and the negative-electrode plate, and collecting electrode plate concerning this invention. It welds, pushing a collecting electrode plate 54 against the edge of the electrode assembly 62, doubling the focus of laser beam B of laser-beam-welding-equipment L with height position P of the contact section of the positive-electrode plate 51 and the collecting electrode plate 54 first, and moving laser-beam-welding-equipment L to an inner circumference side from the periphery side of the electrode assembly 62, in order to carry out laser welding of the collecting electrode plate 54 to the positive-electrode plate 51.
[0028] If laser-beam-welding-equipment L comes to the heights 54a section of a collecting electrode plate 54, irradiation of end laser beam B will be stopped, if the heights 54a section is passed, irradiation of laser beam B will be begun again, and it welds, moving laser-beam-welding-equipment L to a periphery side from the inner circumference side of the electrode assembly 62. When carrying out laser welding of the collecting electrode plate 55 to the negative-electrode plate 52, it carries out similarly.
[0029] Drawing 8 is the flow view (gestalt of the 1st enforcement) of the manufacturing process of the electrode assembly concerning this invention. In addition, STxx shows a step number. (A sign is drawing 3 and referring to drawing 5)
ST01 .... Positive and the negative-electrode plate 51, and the active materials 51b and 52b for 52 are mulled.
ST02 .... The active materials 51b and 52b which mulled by ST01 are made into the shape of a slurry, and it applies to positive and the negative-electrode foils 51a and 52a. However, the above-mentioned non-painted fractions 51d and 52d are formed.
[0030] ST03 .... Positive and the negative-electrode plates 51 and 52 are cut into a regular dimension.
ST04 .... Positive and the negative-electrode plates 51 and 52 are pressed, and thickness including active materials 51b and 52b is fixed.
ST05 .... Positive and the negative-electrode plates 51 and 52 are rolled round, and the electrode assembly 62 is produced.
ST06 .... Laser welding of the collecting electrode plate 55 is carried out to the negative-electrode plate 52.
ST07 .... The electrode assembly 62 and the collecting electrode plate 55 are inserted in a case 56.
[0031] ST08 .... Laser welding of the collecting electrode plate 55 is carried out to a case 56.

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ST09 .... The electrolytic solution 61 is poured in into a case 56.
ST10 .... Laser welding of the collecting electrode plate 54 is carried out to the positive-electrode plate 51.
ST11 .... The electric conduction plate 57 and the lid 59 are inserted through a gasket 58 into a case 56.
ST12 .... It is ******** about the electric conduction plate 57 and the lid 59 to a case 56.
[0032] Drawing 9 (a) - (c) is explanatory drawing (gestalt of the 2nd enforcement) explaining the modification of a collecting electrode plate, and (a) is a cross section with which a perspective diagram and (b) explain the b-b line cross section of (a), and (c) explains the technique of laser welding. In addition, an explanation is omitted about the same configuration as the gestalt of the 1st enforcement. In (a), a collecting electrode plate 64 forms spiral slot 64a which inserts the non-painted fractions 51d and 52d (refer to drawing 5) which are the edges of positive and the negative-electrode plates 51 and 52 (refer to drawing 5). In (b), spiral slot 64a is formed in a collecting electrode plate 64 by the cutting, press working of sheet metal, etc., and the width of face can insert positive and the negative-electrode foils 51a and 52a of positive and the negative-electrode plates 51 and 52 (refer to drawing 5).
[0033] In (c), in order to carry out laser welding of the collecting electrode plate 64 to the positive-electrode plate 51 First, the edge of the positive-electrode plate 51 is inserted to **** 64b of spiral slot 64a of a collecting electrode plate 64, and it is **** 64b (this height position is set to Q.) of the contact section of the positive-electrode plate 51 and the collecting electrode plate 64, i.e., spiral slot 64a. The focus of laser beam B of laser-beam-welding-equipment L is doubled, and it welds, moving laser-beam-welding-equipment L to an inner circumference side from the periphery side of a collecting electrode plate 64.
[0034] If laser-beam-welding-equipment L comes to the heights 64c section of a collecting electrode plate 64, irradiation of end laser beam B will be stopped, if the heights 64c section is passed, irradiation of laser beam B will be begun again, and it welds, moving laser-beam-welding-equipment L to a periphery side from the inner circumference side of a collecting electrode plate 64. When carrying out laser welding of the collecting electrode plate 64 to the negative-electrode plate 52, it carries out similarly. Here, while moving for example, laser-beam-welding-equipment L, you may carry out laser welding only of the about 51 positive-electrode plate length d intermittently. Thereby, influence of the heat which occurs by laser welding can be lessened.
[0035] As described above, by having formed spiral slot 64a which inserts the edge of positive and the negative-electrode plates 51 and 52 (refer to drawing 5) in a collecting electrode plate 64, area of the bond part of positive and the negative-electrode plates 51 and 52, and the collecting electrode plate 64 can be enlarged, and the electric resistance of a bond part can be made smaller.
[0036] Drawing 10 (a) and (b) are explanatory drawings (gestalt of the 3rd enforcement) explaining another modification of the collecting electrode plate concerning this invention, and it is the cross section showing the status that (a) built the perspective diagram and (b) built the collecting electrode plate into the battery cell. In addition, an explanation is omitted about the same configuration as the gestalt of the 1st enforcement. In (a), a collecting electrode plate 65 forms standing-up section 65a for combining with a lid 59 (referring to drawing 4). In (b), the battery cell 66 carries out laser welding of the collecting electrode plate 65 to the positive-electrode plate 51 of the electrode assembly 62, and carries out laser welding of the lid 59 to a collecting electrode plate 65. (c--(refer to (a))) 65b is a weld zone. [51]
In addition, you may perform combination with a collecting electrode plate 65 and the lid 59 with other welding processes.
[0037] Thereby, since a case 56, a collecting electrode plate 55 (refer to drawing 3) and the collecting electrode plate 55, the negative-electrode plate 52 (refer to drawing 3) and the positive-electrode plate 51, a collecting electrode plate 65 and the collecting electrode plate 65, and the lid 59 join together by welding, respectively, the electric resistance of a bond part can be made smaller and the internal resistance of the battery cell 66 can be reduced more.
[0038] Drawing 11 is the cross section (gestalt of the 4th enforcement) showing the battery cell concerning this invention, and omits an explanation about the same configuration as the gestalt of the 1st

enforcement. The battery cell 70 consists of a case 73 with the electric insulation which contains the collecting electrode plate 71 as a positive-electrode terminal which carried out laser welding to the upper part of the positive-electrode plate 51, the collecting electrode plate 72 as a negative-electrode terminal which carried out laser welding to the lower part of the negative-electrode plate 52, and positive and the negative-electrode plates 51 and 52, the separators 53 and 53 and the collecting electrode plates 71 and 72.

[0039] The electrode assembly 62 makes the electrolytic solution 61 (not shown) impregnate. A collecting electrode plate 71 consists of disc-like section 71a and the terminal area 71b attached in the center of this disc-like section 71a. A collecting electrode plate 72 is the same configuration as a collecting electrode plate 71, and consists of disc-like section 72a and the terminal area 72b attached in the center of this disc-like section 72a. A case 73 consists of case mainframe 73a and the covering device material 73b which plugs up opening of this case mainframe 73a. in addition, 73c and 73c -- an insertion -- it is a hole

[0040] the battery cell 70 -- ****** -- the electrode assembly 62 -- collecting electrode plates 71 and 72 -- laser welding -- carrying out -- an insertion of case mainframe 73a -- a hole -- 73c -- terminal area 72b of a collecting electrode plate 72 -- pressing fit -- case mainframe 73a -- the electrode assembly 62 and the collecting electrode plates 71 and 72 -- containing -- an insertion of covering device material 73b -- a hole -- while terminal area 71b of a collecting electrode plate 71 is pressed fit in 73c, covering device material 73b is welded on case mainframe 73

[0041] In addition, although laser welding of the collecting electrode plates 54, 55 (refer to drawing 3), 64 (refer to drawing 9), 65 (refer to drawing 10), 71, and 72 was carried out to positive and the negative-electrode plates 51 and 52 with the gestalt of enforcement of this invention, it may not restrict to this and resistance welding and an electron beam welding are sufficient. Moreover, the combination with positive and the negative-electrode plates 51 and 52, and the collecting electrode plates 54, 55, 64, 65, 71, and 72 in the battery cells 42 (refer to drawing 3), 66 (refer to drawing 10), and 70 of this invention can be adapted for rechargeable batteries, such as a lithium ion battery, a lead cell, a nickel-cadmium battery, and a nickel hydoride battery, or an electric double layer capacitor and an aluminum foil form electrolytic capacitor.

[0042]

[Effect of the invention] this invention demonstrates the following effect by the above-mentioned configuration. Since the accumulation-of-electricity element of a claim 1 carried out laser welding of positive and the negative-electrode terminal to positive and the negative-electrode plate, respectively, by laser welding, it can combine positive and a negative-electrode terminal with positive and a negative-electrode plate certainly, and can raise a reliability. Moreover, the electric resistance of the bond part of positive and a negative-electrode plate, and positive and a negative-electrode terminal can be made smaller, and the internal resistance of an accumulation-of-electricity element can be reduced more.

[0043] Since the accumulation-of-electricity element of a claim 2 formed the slot which inserts the edge of positive and a negative-electrode plate in positive and a negative-electrode terminal, it can enlarge area of the bond part of positive and a negative-electrode plate, and positive and a negative-electrode terminal, can make the electric resistance of a bond part smaller, and can reduce the internal resistance of an accumulation-of-electricity element more.

[0044] Since the accumulation-of-electricity element of a claim 3 used positive and the negative-electrode plate as the roll-like electrode plate in piles, it contacts positive and a negative-electrode terminal at the edge of a roll-like electrode plate equally and laser welding of it can be carried out, combination by laser welding can be more made into an authenticity, and the stable quality can be obtained. Moreover, the electric resistance of the bond part of positive and a negative-electrode plate, and positive and a negative-electrode terminal can be made smaller, and the internal resistance of an accumulation-of-electricity element can be reduced more.

[Translation done.]